

SPACE MEDICINE & Medical Operations Overview

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Medical Operations

Johnson Space Center

HOUSTON

FIRST WORD FROM THE MOON





SPACE AND LIFE SCIENCES DIRECTORATE

Space Medicine & Health Care Systems Office

Medical Operations Objective

To ensure the health, safety, and well being of
the astronaut corps and ground support team
during all phases of space flight













Mission Support

On-orbit Flight Control Room (FCR) Staffing



Surgeon Console - FCR

Physiological Issues

- Space Motion Sickness (SMS)
- Cardiovascular
- Neurovestibular
- Musculoskeletal
- Behavioral/Psycho-social

Space Motion Sickness (SMS)

- **Incidence**

- Affects approximately 70% of crewmembers
- 10% of cases severe

- **Symptoms** - From loss of appetite to nausea and vomiting

- **Time course** - Onset from MECO to 24 hours; peak symptoms 24 to 48 hours; symptoms resolve by 72 to 96 hours

- **Causes**

- Neurovestibular - otolith mismatch, sensory conflicts
- Fluid shift

- **Treatment**

- Decreased activity
- 1-G orientation
- Medication (Phenergan IM)

Cardiovascular

Changes in redistribution of body fluids cause inability of the body to adapt to rapid circulatory changes, producing orthostatic symptoms postflight

- **Symptoms** – Dizziness, lightheadedness,
- **Time course** – From reentry to several hours postlanding
- **Causes**
 - Fluid shifts
 - Baroreceptor
- **Treatment**
 - Fluid loading
 - On-orbit exercise benefit
 - Liquid cooling garment
 - Medications

Neurovestibular

In-flight changes in neural feedback function that produce postural imbalance and loss of coordination postflight

- **Incidence** - All crewmembers are affected to some degree
- **Symptoms** - From vertigo and unstable gait to nausea and vomiting
- **Time course** - From landing to 48 - 72 hours postlanding
- **Causes** - Neurovestibular-otolith and proprioception readaptation
- **Treatment**
 - Avoid rapid head movements
 - Slow but progressive increase in activity
 - Medication (Phenergan, Antivert)

Behavioral/Psycho-Social

Changes in crew mood, morale, and circadian rhythm

- **Incidence** – Affects all crewmembers to some degree
- **Symptoms** – Fatigue and irritability, performance
- **Time course** – Depends on flight plan
- **Causes**
 - Work load
 - Sleep habits and facilities
 - Crew personalities, “crew space”, and cultural differences
 - Temperature
 - Noise
 - Odors
 - Atmosphere
 - Diet
 - Lack of family contact
- **Treatment** – Treat causes

Space Flight Environmental Issues

- Radiation
- Toxic products and propellants
- Habitability
- Atmosphere
- Medical events

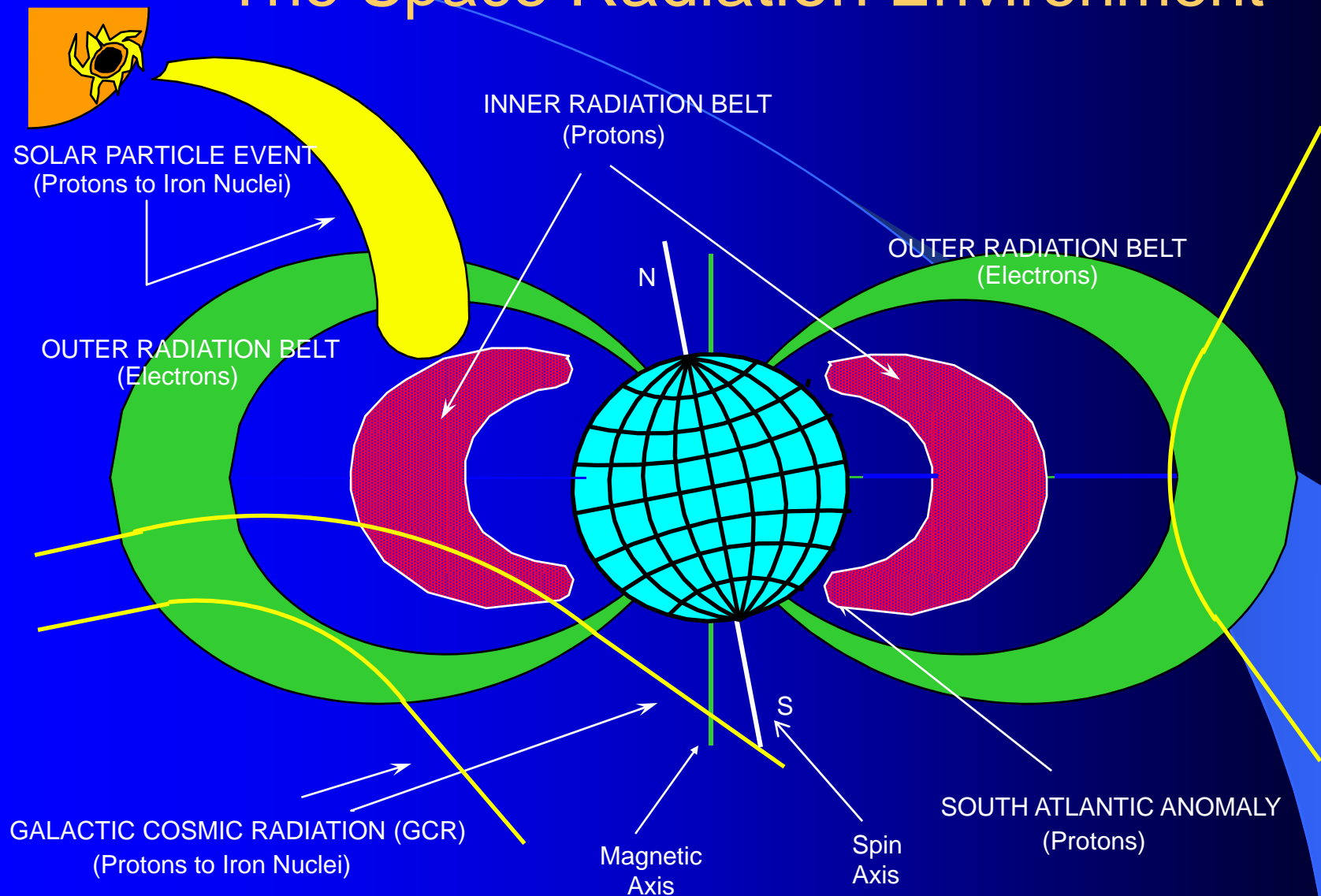
Medical events in U.S. Space Program

- Apollo 8 crew – 1st Americans to report space motion sickness
- Apollo 9 - space motion sickness caused EVA to be rescheduled (1st timeline change due to medical cause)
- Apollo 11 – Type 1 DCS in command module pilot
- Apollo 13 – Kidney infection during mission
- Apollo 15 – Cardiac dysrhythmia (PVC, PAC, bigeminy) during lunar EVA
- Apollo Soyuz Test Project – Nitrogen Tetroxide chemical pneumonitis on reentry

Medical Events in Russian Space Program

- Events not resulting in mission termination or early return
 - Spacecraft fires - 1971, 1977, 1988, 1997
 - Kidney Stone - 1982
 - Hypothermia during EVA - 1985
 - Psychological stress reaction - 1988
 - Spacecraft depressurization - 1997
 - Toxic atmosphere - 1997

The Space Radiation Environment



Representation of the major sources of ionizing radiation of importance to manned missions in low-Earth orbit. Note the spatial distribution of the trapped radiation belts.



Systems & Crew Training



KC-135 “Weightless Wonder, Vomit Comet”



Hardware Testing and Procedure Validation



Systems & Crew Training

Shuttle Orbiter Medical System (SOMS)







DRUG SUBPACK

Systems & Crew Training

Health Maintenance System (HMS)

Defibrillator & Respiratory Support Pack (RSP)

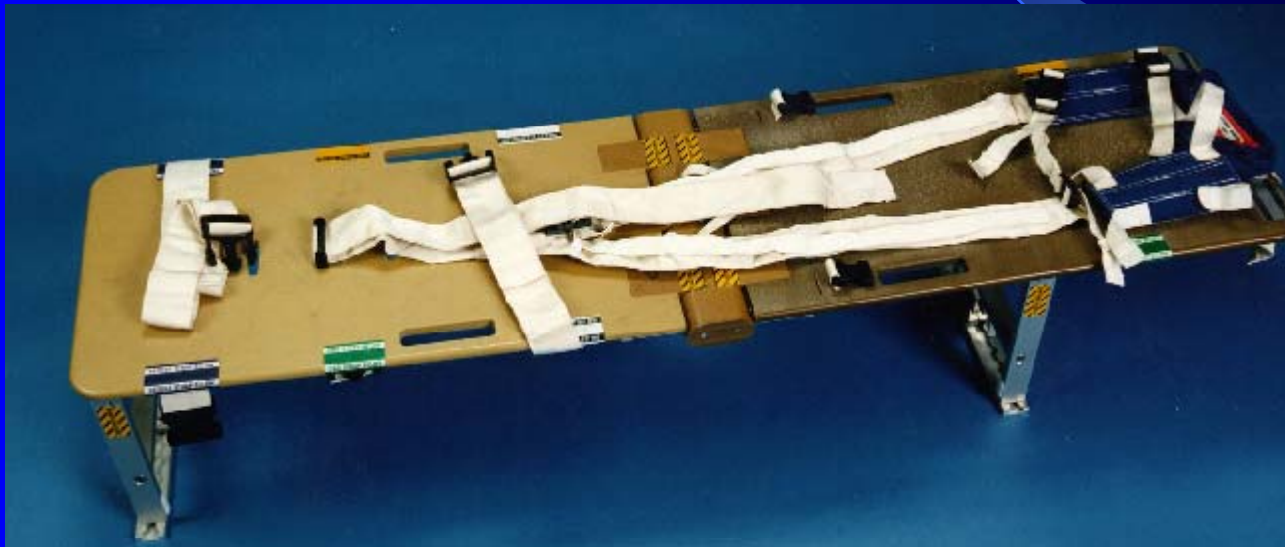


Defibrillator

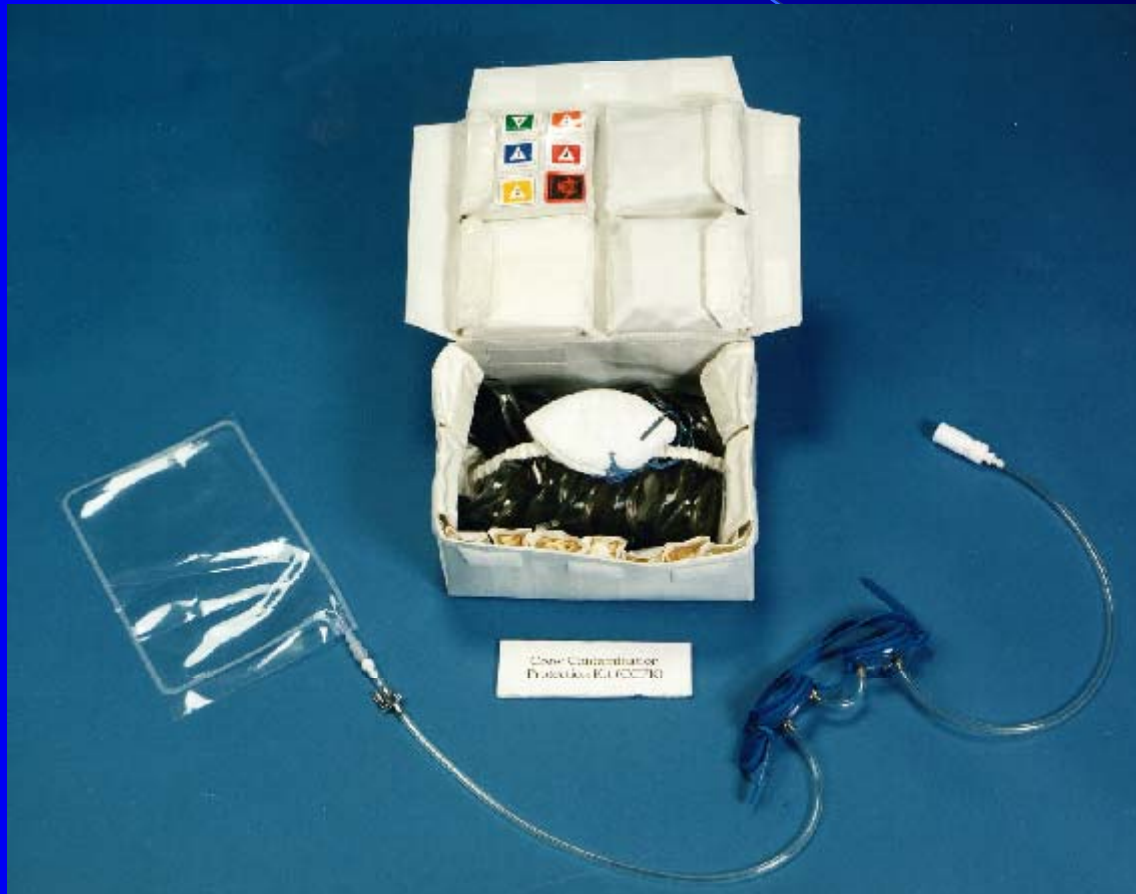


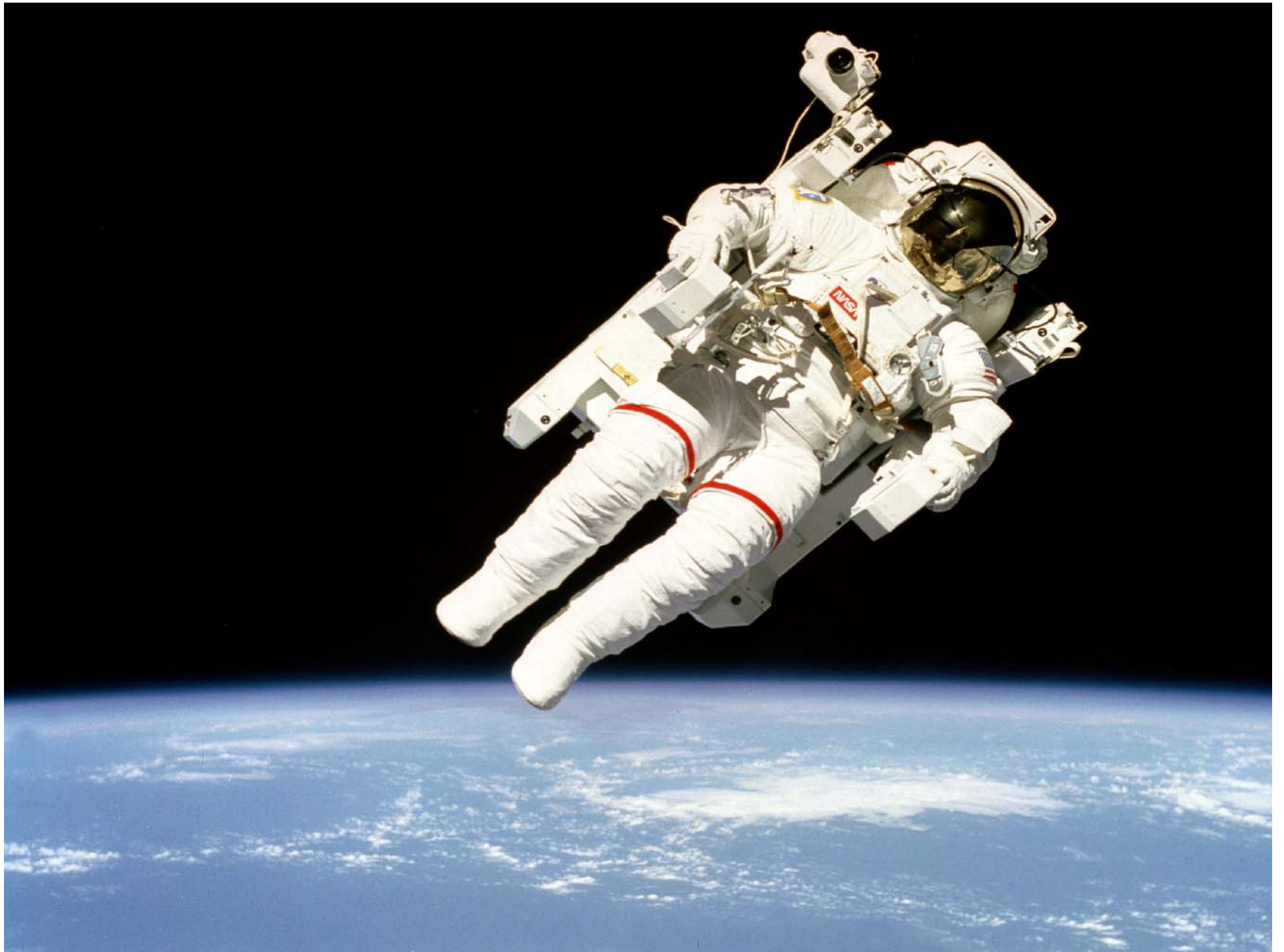
RSP

Crew Medical Restraint System (CMRS)



Crew Contamination Protection Kit (CCPK)

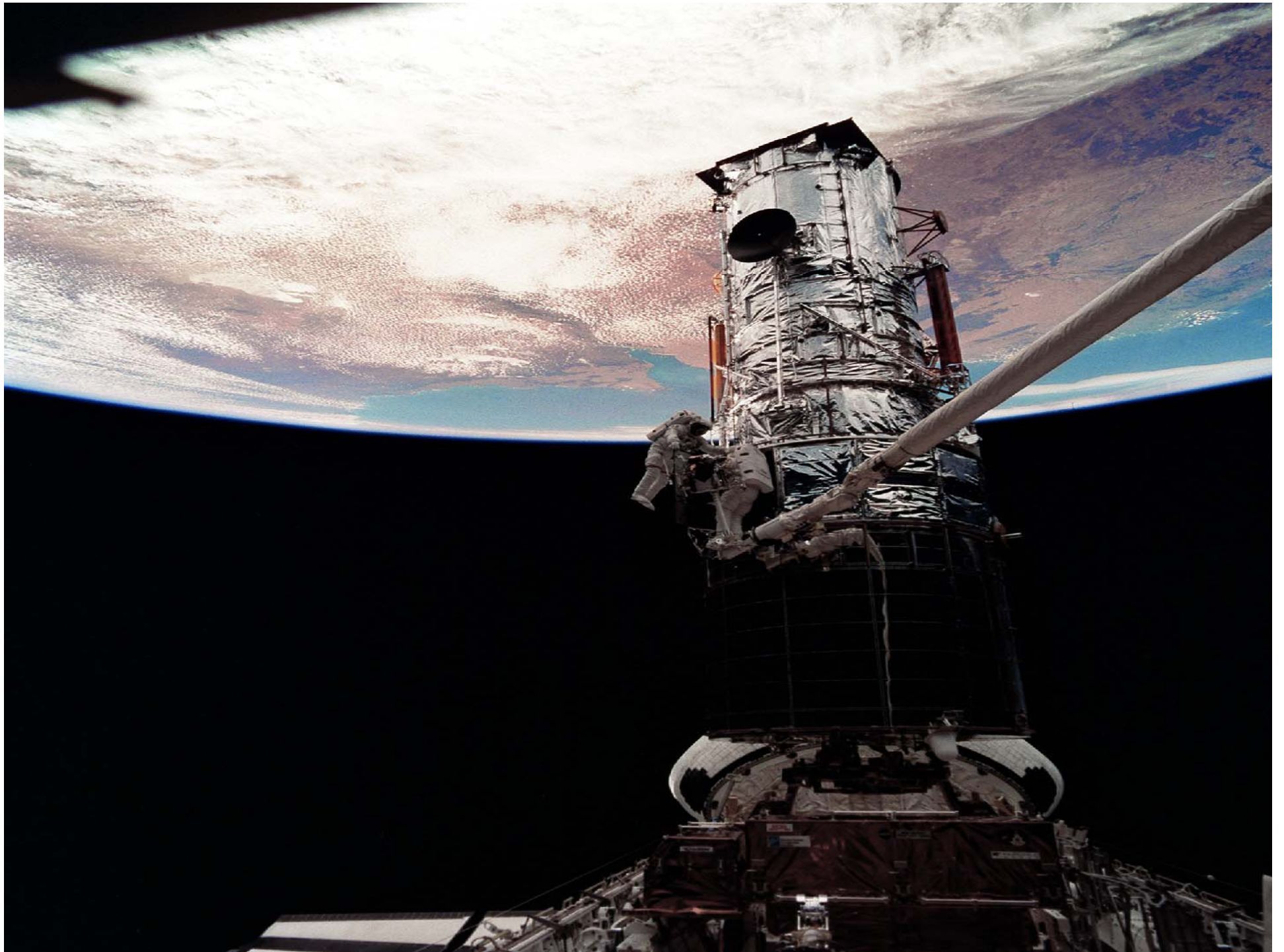




Mission Support

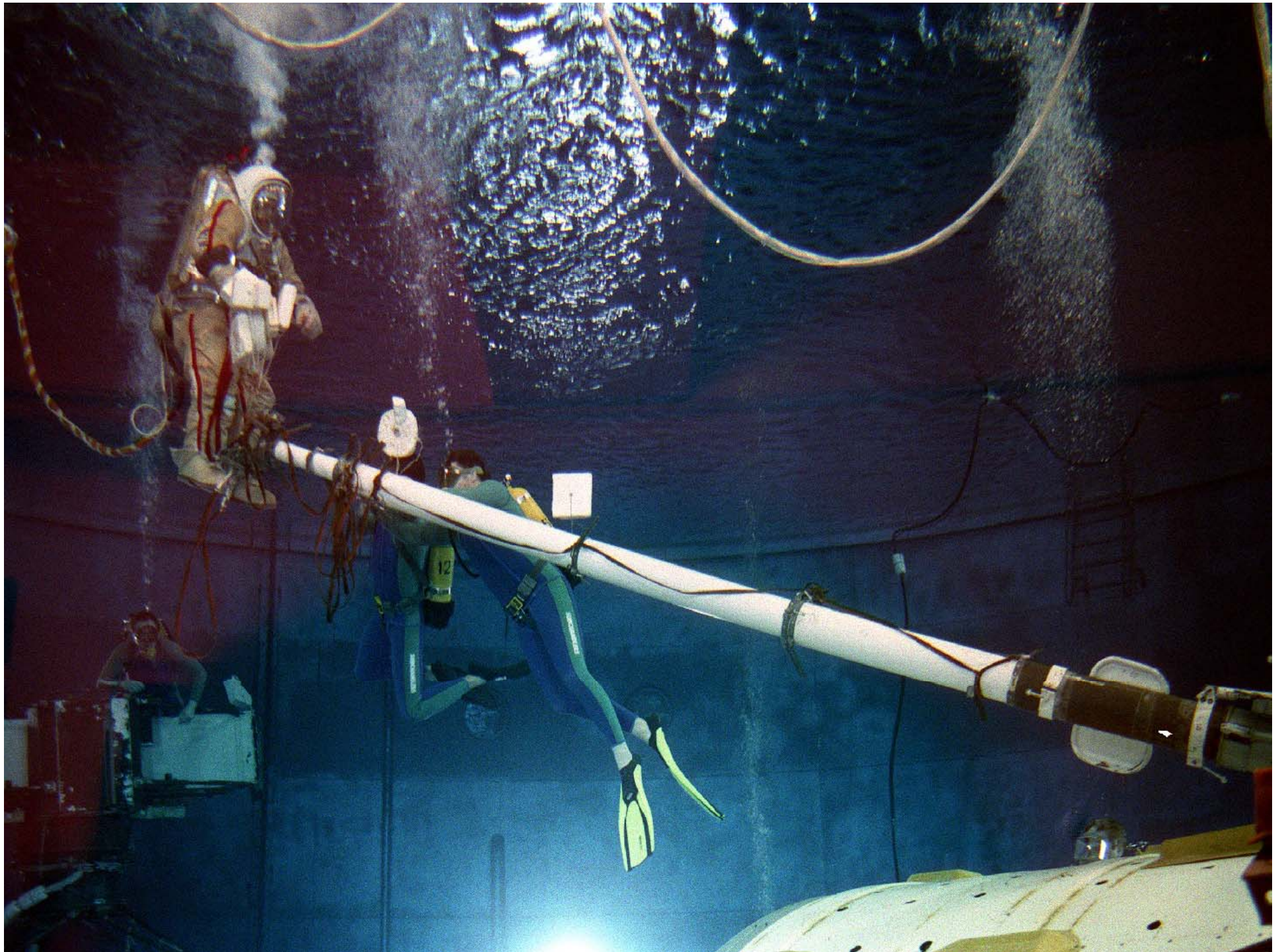
- Extravehicular Activity (EVA) Monitoring











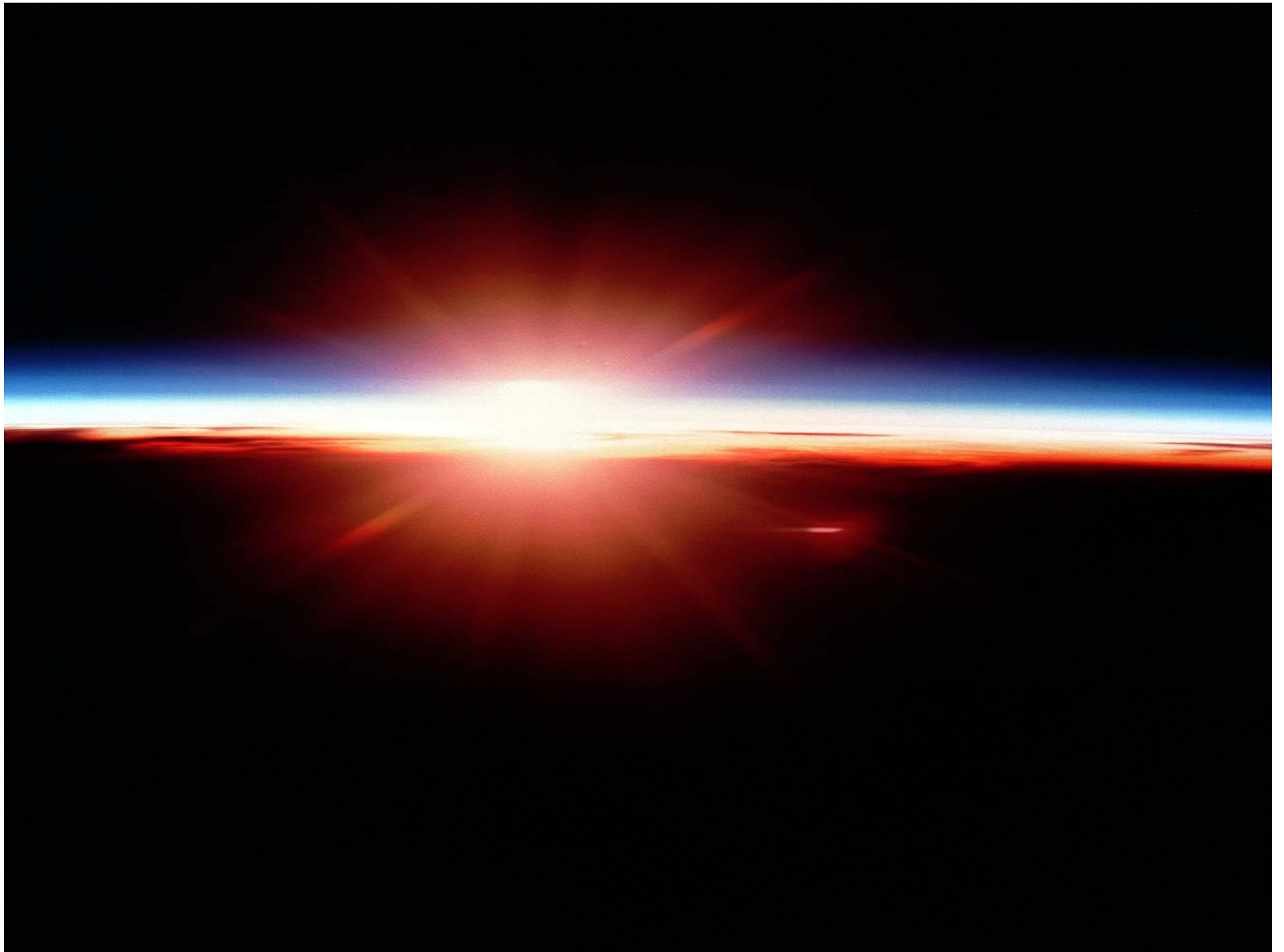
PRP EXERCISE STRATEGIES



**Upright dual arm
and leg cycle
exercise
(ALE)**



**Semi-recumbent intermittent
light exercise simulating
astronaut tasks
(ILE)**









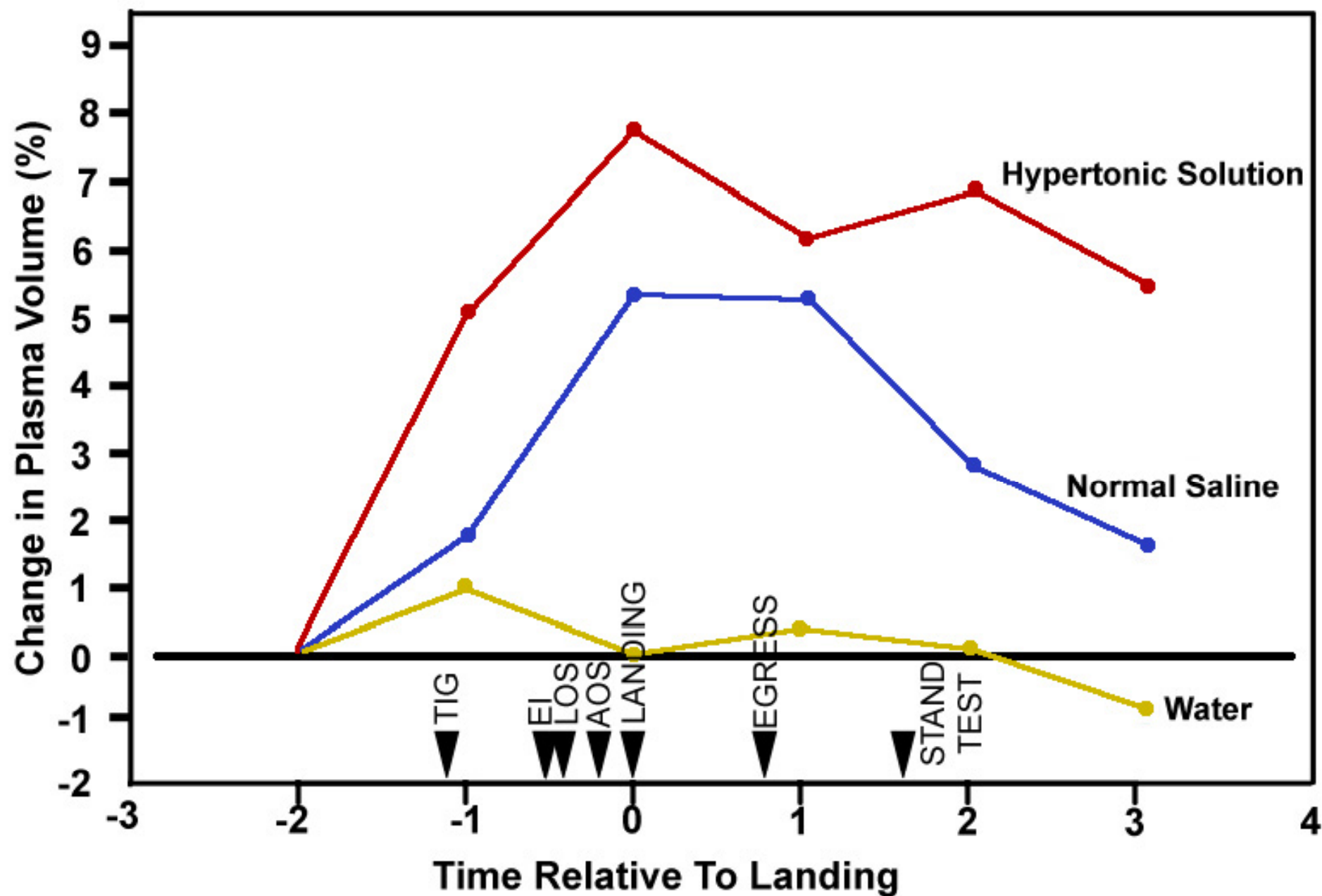




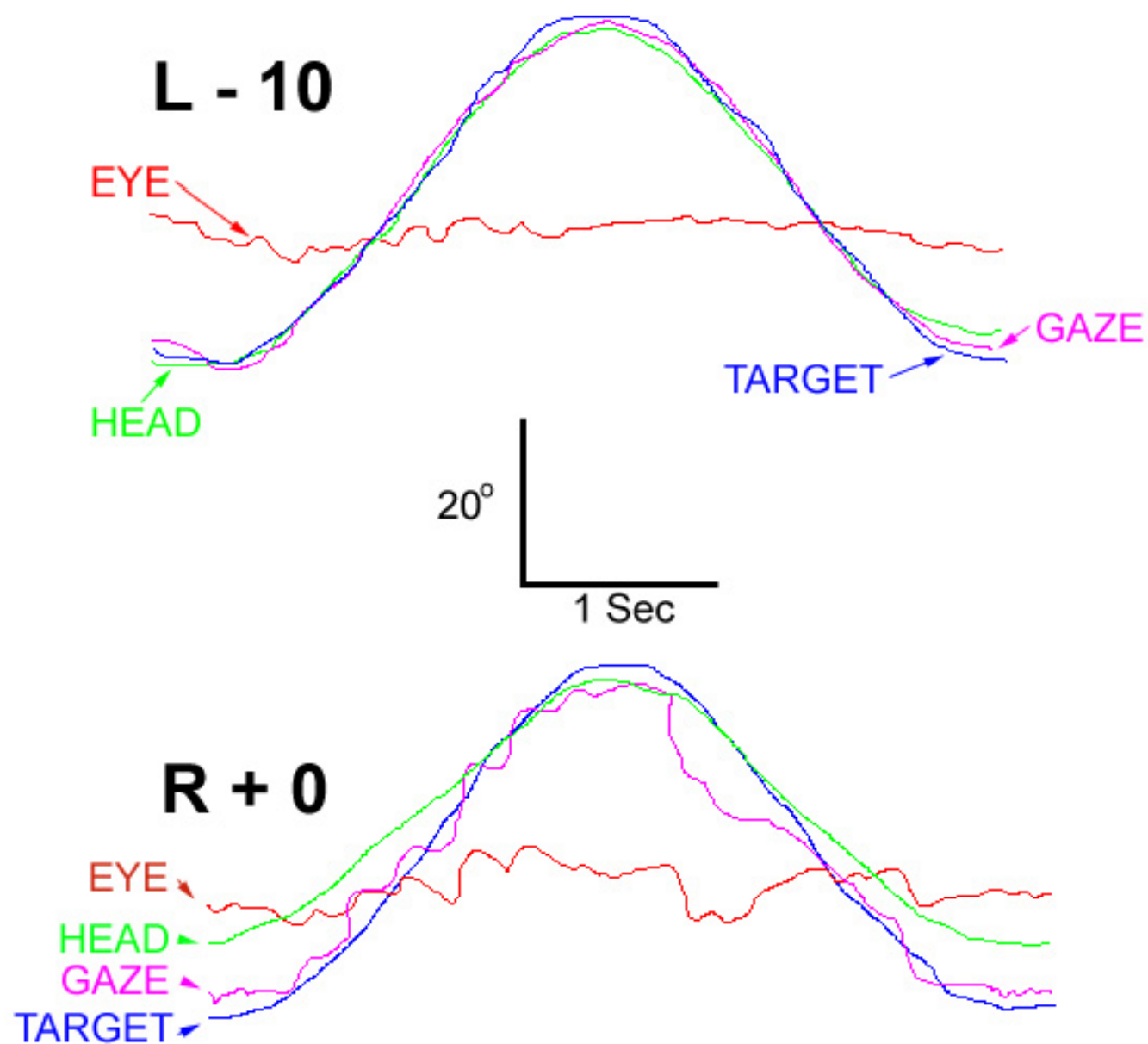


Оранжерея "СВЕТ"

STS FLUID LOADING COUNTERMEASURES



Vertical Pursuit Tracking With Head and Eye











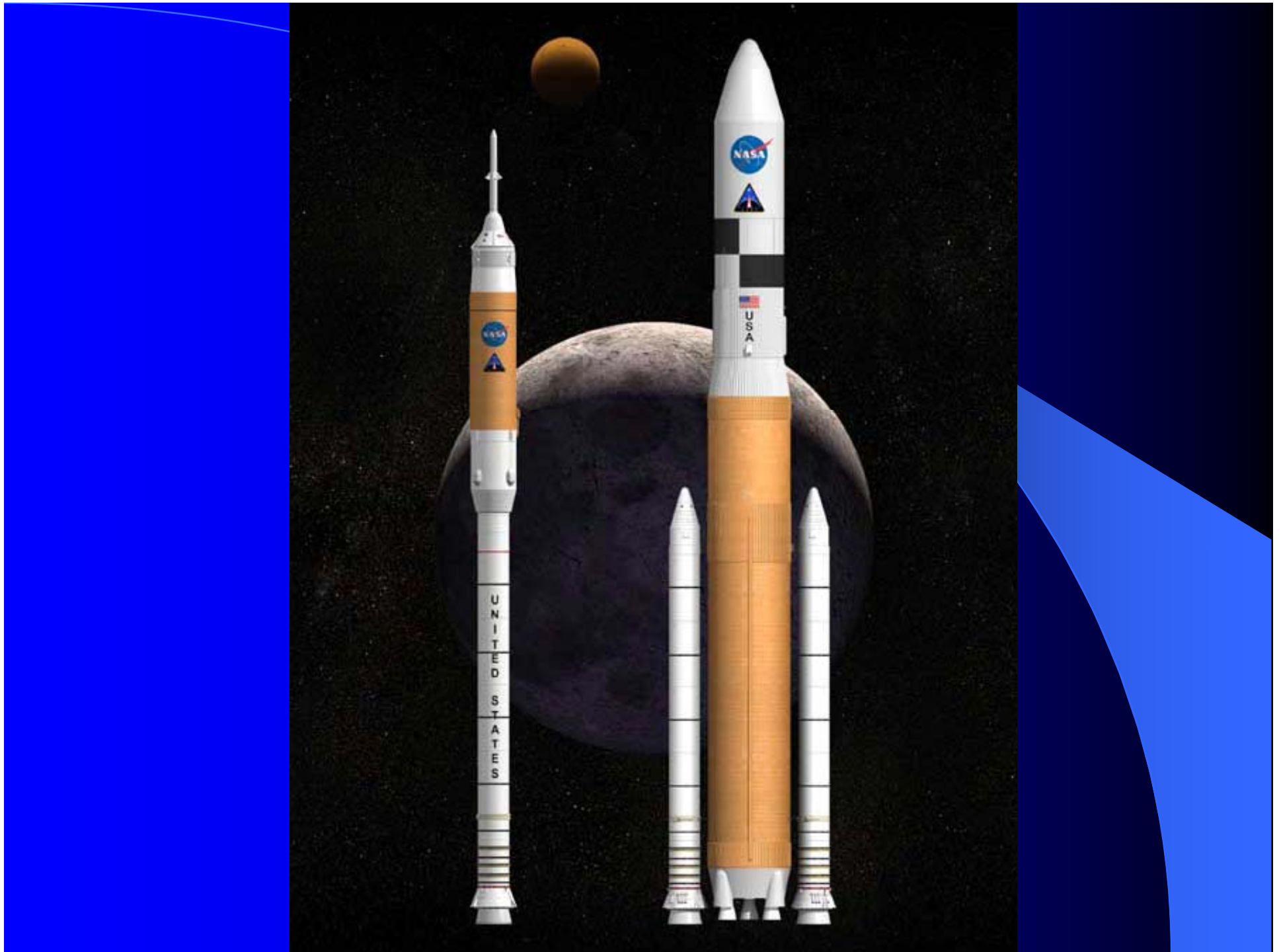
Astronaut Health



- Physical training and rehabilitation

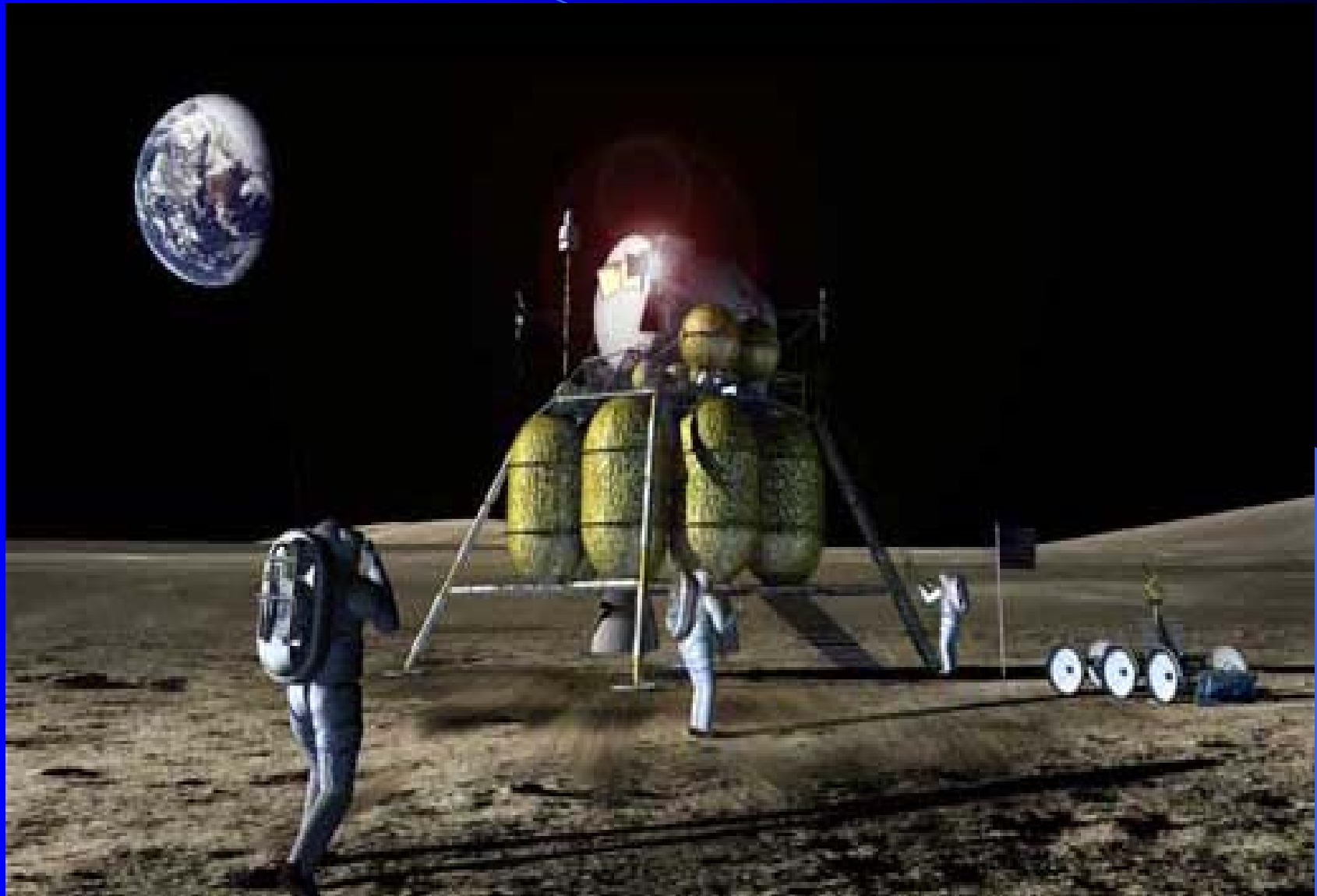


















Perspective

Earth



Venus



Mars



Mercury



Pluto



Jupiter

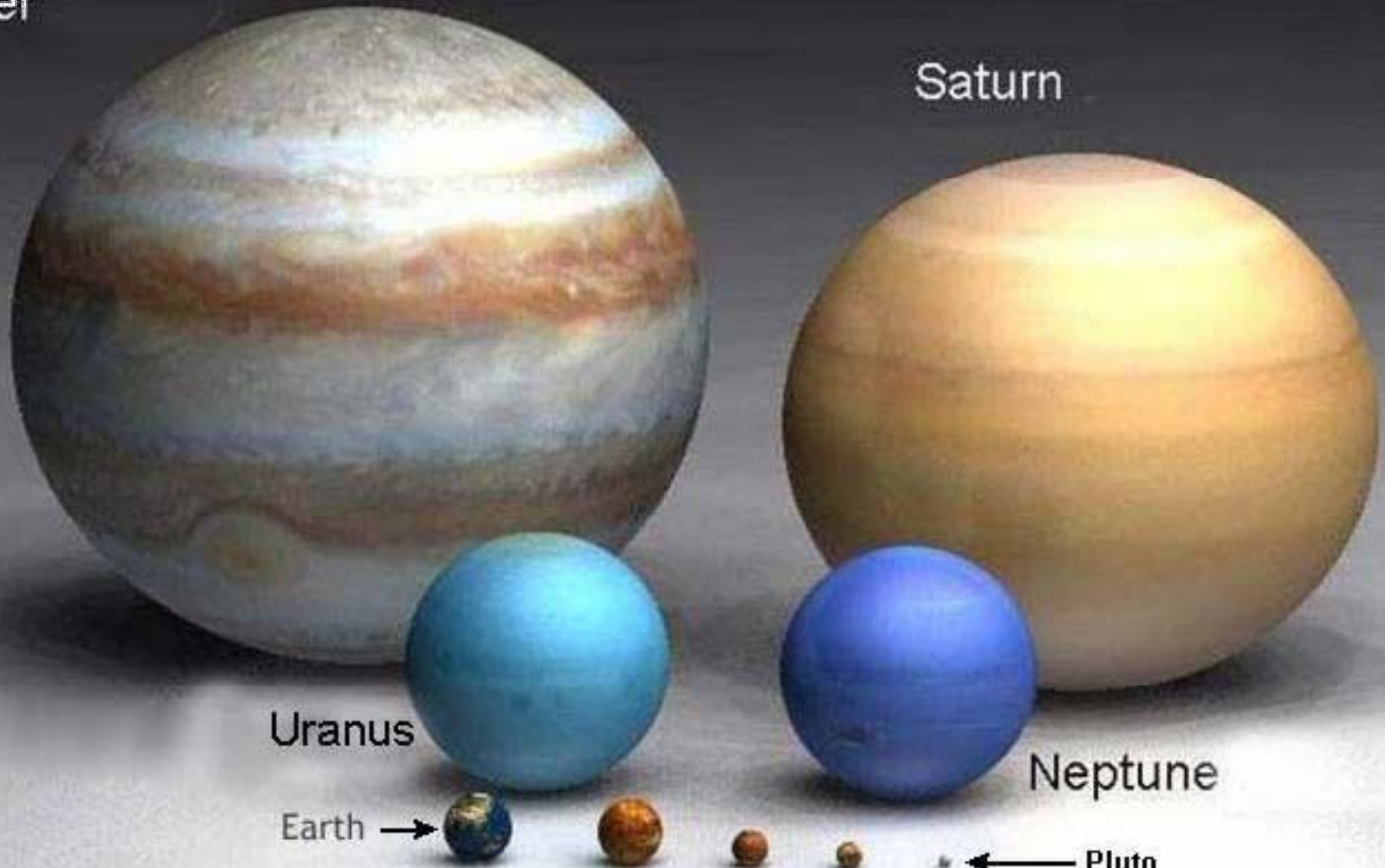
Saturn

Uranus

Neptune

Earth →

← Pluto



Sun

Jupiter

Earth

Pluto





Sun



Sirius



Pollux



Arcturus

Jupiter is about 1 pixel in size

Earth is invisible at this scale

Betelgeuse

Antares

Sun (1 pixel)
Jupiter is invisible at this scale
Sirius Pollux Arcturus



Rigel



Aldebaran

